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Relocating Vessels of Interest in Maritime Security Operations

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For the MORS Blue Water MDA WG

October 29, 2009



Defence Research and
Development Canada

Recherche et développement
pour la défense Canada

Canada



Outline

- Background of Op ALTAIR and CTF 150
- Reachback request
- Development of a VOI planning tool
- Lessons learned
- Current Situation
 - Further tool deployments
 - Further development inside a larger project



Background of Op ALTAIR

- CDN contribution to Op ENDURING FREEDOM
- Iroquois, Protecteur, and Calgary for Roto 4
- Cmdre Davidson in command of CTF 150 from Jun to Sep 2008
- Reachback request identified 2 requirements





Request for Reach Back

- Formal request copying chain of command with deadline for initial response
- Back and forth dialogue to clarify problems with its requirement and intent
- Focus shifted to two problems
 - Arranging limited assets over a large area to best achieve mission success and MDA
 - Looking for vessels that have fallen off the Recognized Maritime Picture (RMP)
- Back and forth continued during tool design by sending the documentation for comment before final product



VOIR Development (VOI Reconnaissance Tool)

- Developed as a stand alone Matlab application
- Estimate the position of a vessel based on past known location and up to 3 likely courses
- Results plotted on a geographic map that includes locations/areas of interest
- Probabilities calculated and transferred to a “heat map” for better visualization
- Various statistics calculated
- Estimated helicopter search times



VOIR GUI

VOIR The VOI Reconnaissance Tool 1.11.3

VOI Data

Latitude (N/S) Longitude (E/W)

Last Position (DMS)

Top Speed (kts)

Last known position DTG

Analysis DTG

Delay (hrs)

Blue Force Asset

☒ Display a Blue Force Position

Asset Name

Latitude (DMS N/S)

Longitude (DMS E/W)

COA 1

☒ COA 1

Probability (%)

Heading (deg) +/-

Likely Speed: Min/Max (kts)

Expected Contact Density: Min per 100 nm2

Max per 100 nm2

COA 2

☒ COA 2

Probability (%)

Heading (deg) +/-

Likely Speed: Min/Max (kts)

Expected Contact Density: Min per 100 nm2

Max per 100 nm2

COA 3

☐ COA 3

Probability (%)

Heading (deg) +/-

Likely Speed: Min/Max (kts)

Expected Contact Density: Min per 100 nm2

Max per 100 nm2

Map Limits

Latitude (N/S) Longitude (E/W)

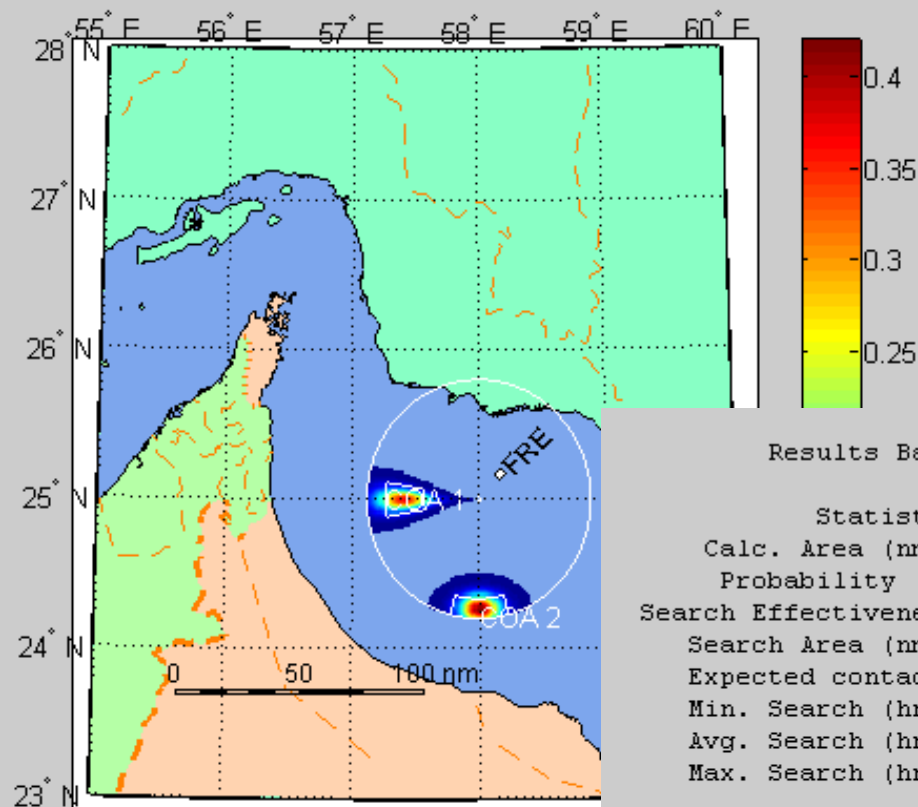
South-West (DMS)

North-East (DMS)

Grid Spacing (deg)



VOIR Output



Last Known DTG: 221238ZAP:
Analysis DTG: 221638ZAP:
Heat Map Cell Size = 1 r

Results Based on Input Parameters (Outlined Areas)

Statistic	COA 1	COA 2	COA 3	Total	Other
Calc. Area (nm ²)	178.7	184.3	NaN	363.0	6850.0
Probability (%)	33.5	40.0	NaN	73.5	26.5
Search Effectiveness	18.7	21.7	NaN	20.2	0.4
Search Area (nm ²)	176.0	184.0	NaN	360.0	NaN
Expected contacts	9 - 18	9 - 18	NaN	NaN	NaN
Min. Search (hrs)	1.0	1.0	NaN	NaN	NaN
Avg. Search (hrs)	1.5	1.5	NaN	NaN	NaN
Max. Search (hrs)	2.0	2.0	NaN	NaN	NaN

Results Based on Coloured Heat Map Areas of each COA

Statistic	COA 1	COA 2	COA 3	Total	Other
Calc. Area (nm ²)	688.0	609.0	NaN	1297.0	5916.0
Probability (%)	50.0	50.0	NaN	99.9	0.1
Search Effectiveness	7.3	8.2	NaN	7.7	0.0



Observations and Lessons Learned

- An embedded scientist is a great asset
 - Need a liaison and a military champion within
 - Need ongoing dialogue
- Keep it simple during operations
 - Limited time
 - Avoid obstacles and delays
- Follow-on work must be managed



Positive Fleet Response

... But Also Room for Development ...

- Overall excellent:
 - VOIR “could be of great use”
 - “There are several advantages to using” VOIR
 - Visualization with map and color codes
 - Automated rather than manual calculations
 - Uncertainty in VOI course taken into account
 - Variable VOI speed
 - “TFAS will continue to use this tool... during this deployment”



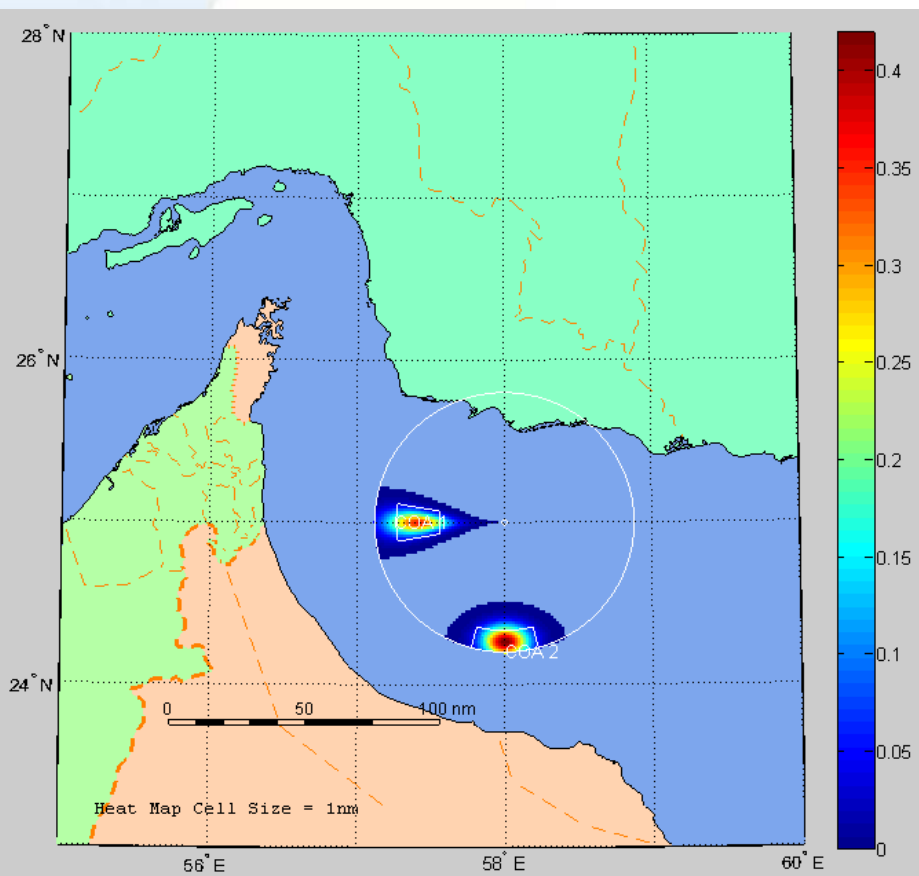
Current Situation

- Maritime Evaluation – formal tasking process
 - Ships performing Maritime Security Operations are to evaluate VOIR and provide feedback
- VOIR 1.11 developed for WINNIPEG deployment
 - Saving/loading scenarios, improved interface, User guide
- VOIR 1.11.3 developed for FREDERICTON deployment
 - Blue Force position added
- Development of VOIR to continue within an Applied Research Project which began in April
 - Land avoidance, previously searched areas, VOI waypoints, alternate situations
 - Covers from R&D right up to operational use
- ARP also aims to:
 - develop a tool for the placement of TG assets
 - continue work on the Recognized Maritime Picture



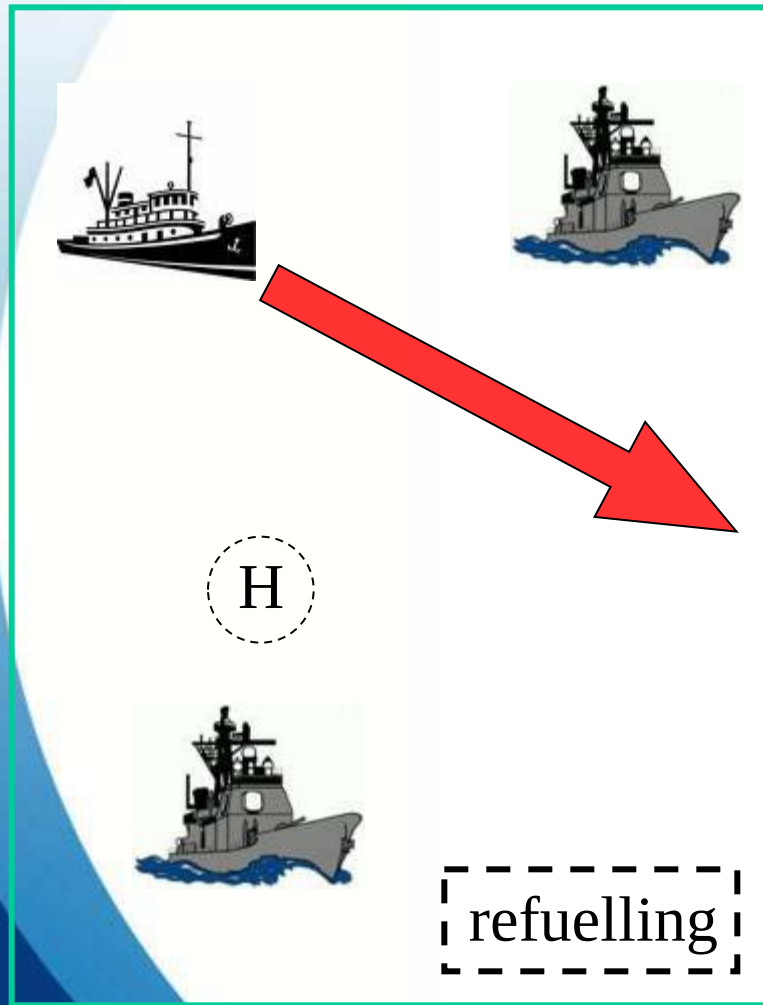
WBE 2: VOI Planning Tool

- Locate and observe a known VOI with avail resources
- Include
 - Data constraints, e.g. possible destinations vs start points
 - PIM track estimates
 - Land and boundaries
 - Variety of surveillance assets (ships, helos, MPAs, UAVs, satellites, fixed sensors)
 - Unsuccessful searches and negative information
 - Imperfect surveillance
 - Various VOI objectives
 - Need to operate covertly
- Coordinate Training package, SOPs, etc.





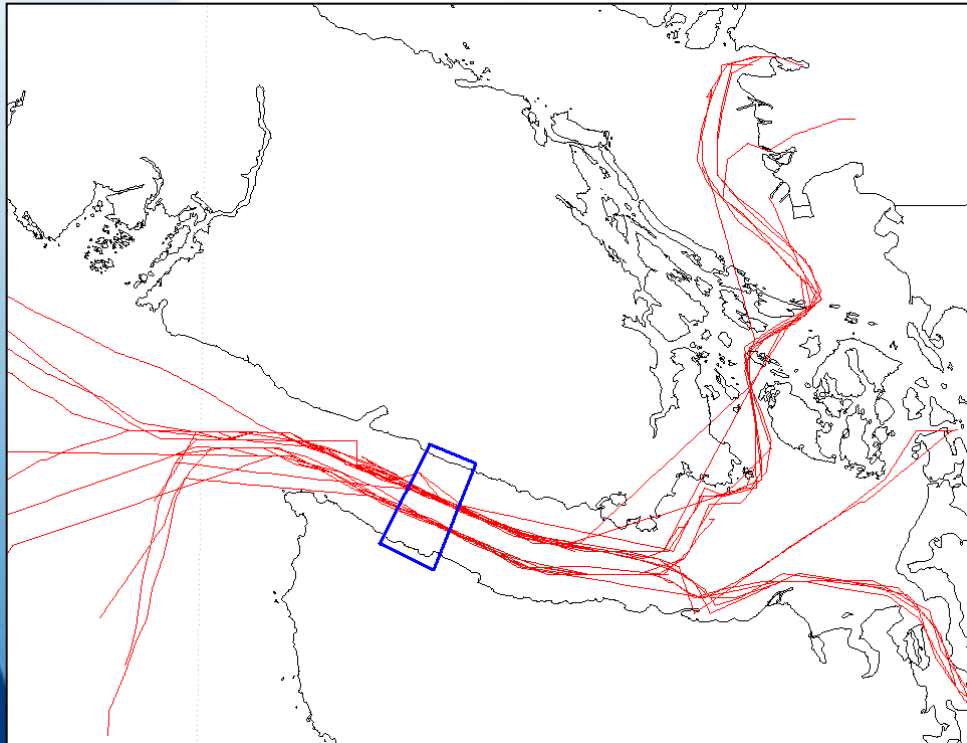
WBE 3: Planning Tools for MDA Resource Deployment



- Plan resource deployment that achieves best chance of mission success
- Capabilities
 - Handle combinations of mission objectives & tasks
 - Dynamic to allow for planned & unscheduled changes in fleet and other asset composition
 - Balance variety of resources & their employment restrictions
 - Propose changes when current deployment is compromised
- Manage actual plan
 - Generate tasking instructions



WBE 4: RMP Tools & Analysis



- Prototype RMP architecture and help direct the operational RMP architecture
- Further develop Prototype RMP Analysis Toolset (PRAT) & its operationalization into RAT
 - Develop or refine metrics and reports for the RMP
 - Use for TTCP AG8 analysis for Trident Warrior 09
- Analysis
 - New analyses to support clients
 - Recurring analysis from existing tools
 - Consultation to other C4ISR projects



Summary

- Delivered a VOI Reconnaissance (VOIR) Tool to CTF 150
- Started a new Applied Research Project to:
 - Continue work on VOIR;
 - Develop an asset deployment tool; and
 - Continue work on RMP architecture and RMP Analysis Toolset
- Looking for partners with common interests in each of these three areas



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